

## CLAIMS:

1. A metal oxide/hydroxide or composite metal oxide/hydroxide material comprising a surface modified to facilitate co-continuity to an external environment, said metal  
5 oxide/hydroxide or composite material having a high mesoporous area.
2. A composite metal oxide/hydroxide material comprising a substrate with a surface modified to facilitate co-continuity to an external environment and a metal oxide/hydroxide material attached to, bound within or otherwise associated with  
10 said substrate such that the composite material maintains co-continuity to an external environment.
3. A metal oxide/hydroxide material according to claim 1 having a mesoporous area greater than  $150 \text{ m}^2/\text{g}$ .  
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4. A composite metal oxide/hydroxide material according to claim 1 having a mesoporous area greater than  $800 \text{ m}^2/\text{g}$ .
5. A process for generating a metal oxide/hydroxide material with a surface modified  
20 to facilitate co-continuity to an external environment comprising treating a metal salt with base in an aqueous medium for a time and under conditions sufficient to precipitate metal oxide/hydroxide in said aqueous medium, removing water from the aqueous medium by evaporation to provide a solid residue, and removing salt from the solid residue to thereby generate said metal oxide/hydroxide material with  
25 surface modified to facilitate co-continuity to an external environment.
6. A process for generating a metal oxide material with a surface modified to facilitate co-continuity to an external environment comprising treating a metal salt with base in an aqueous medium for a time and under conditions sufficient to precipitate  
30 metal hydroxide in said aqueous medium, removing water from the aqueous medium by evaporation under conditions that convert metal hydroxide to metal

- 32 -

oxides to provide a solid residue, and removing salt from the solid residue to thereby generate said metal oxide material with surface modified to facilitate co-continuity to an external environment.

- 5    7.    A process for generating a metal hydroxide material with a surface modified to facilitate co-continuity to an external environment comprising treating a metal salt with a base in an aqueous medium for a time and under conditions sufficient to precipitate metal hydroxide in said aqueous medium, removing water from the aqueous medium by evaporation under conditions that do not convert the metal
- 10    hydroxide to metal oxide to provide a solid residue, and removing salt from the solid residue to thereby generate said metal hydroxide material with surface modified to facilitate co-continuity to an external environment.
- 15    8.    A process for generating a composite metal oxide/hydroxide material with a surface modified to facilitate co-continuity to an external environment comprising treating a metal salt with a base in an aqueous medium in the presence of a substrate with a surface modified to facilitate co-continuity to an external environment for a time and under conditions sufficient to precipitate metal oxide/hydroxide, removing water from the aqueous medium by evaporation to provide a solid residue of metal
- 20    oxide hydroxide attached to, bound within or otherwise associated with said substrate, and removing salt from the solid residue to thereby generate said composite metal oxide/hydroxide material with surface modified to facility co-continuity to an external environment.
- 25    9.    A process for generating a composite metal oxide material with a surface modified to facilitate co-continuity to an external environment comprising treating a metal salt with base in an aqueous medium in the presence of a substrate with a surface modified to facilitate continuity to an external environment for a time and under conditions sufficient to precipitate metal hydroxide, removing water from the aqueous medium by evaporation under conditions that convert metal hydroxide to
- 30    metal oxide to provide a solid residue of metal oxide attached to, bound within or

- 33 -

otherwise associated with said substrate, and removing salt from the solid residue to thereby generate said composite metal oxide material with surface modified to facilitate co-continuity to an external environment.

- 5 10. A process for generating a composite metal hydroxide material with a surface modified to facilitate co-continuity to an external environment comprising treating a metal salt with base in an aqueous medium in the presence of a substrate with a surface modified to facilitate continuity to an external environment for a time and under conditions sufficient to precipitate metal hydroxide, removing water from the
- 10 aqueous medium by evaporation under conditions that do not convert the metal hydroxide to metal oxide to provide a solid residue of metal hydroxide attached to, bound within or otherwise associated with said substrate, and removing salt from the solid residue to thereby generate said composite metal hydroxide material with surface modified to facilitate co-continuity to an external environment.
- 15 11. A process according to any one of claims 5 to 7 wherein the water is removed from the aqueous medium by the application of heat.
12. A process according to claim 11 wherein the aqueous medium is heated to a
- 20 temperature of from 100°C to 110°C.
13. A process according to any one of claims 5 to 12 wherein the salt is removed by washing the solid residue with water.
- 25 14. A process according to claim 13 wherein the washed solid residue is dried.
15. A process according to any one of claims 5 to 7 wherein the metal oxide/hydroxide has a mesoporous area of greater than 100 m<sup>2</sup>/g.
- 30 16. A process according to any one of claims 8 to 10 wherein the composite metal oxide/hydroxide has a mesoporous area of greater than 500 m<sup>2</sup>/g.

- 34 -

17. A process according to any one of claims 5 to 16 wherein the metal salt is selected from the halides (e.g. chlorides, fluorides, bromides and iodides), acetyl acetonates, sulphides, sulphates, nitrates, nitrides, cyanides, carbides, silanes, alkoxysilanes, and acetates of transition metal elements and metal salts comprising halogen oxoanions (such as bromate and iodate), metal and transition metal oxoanions (such as permanganate, chromate and arsenate) and organic oxoanions, such alkoxides and carboxylates (e.g. ethoxides, acetates and palmitates).
18. A process according to any one of claims 5 to 17 wherein the metal salt is treated with an oxidizing agent to place it in a suitable oxidation state for oxide/hydroxide formation.
19. A process according to any one of claims 5 to 18 wherein the metal salt is doped/mixed with one or more additional metals, metal salts, complexes or other chemical species to confer desirable properties on the metal oxide/hydroxide or composite metal oxide/hydroxide material.
20. A process according to any one of claims 5 to 19 wherein the base is a strong inorganic base.
21. A process according to claim 20 wherein the base is selected from sodium hydroxide, potassium hydroxide and ammonium hydroxide.
22. A process according to any one of claims 5 to 21 wherein the amount of base is chosen such that the final pH of the aqueous medium is in the range of 7.5 to 8.5.
23. A process for preparing a metal or composite metal material having a surface modified to facilitate co-continuity to an external environment comprising preparing a metal oxide/hydroxide or composite metal oxide/hydroxide material according to the process of any one of claims 5 to 22 and subjecting the

- 35 -

oxide/hydroxide or composite material to reducing conditions such that the oxide hydroxide is reduced to the corresponding metal.

24. A method for removing toxic components from an environment comprising  
5 contacting the environment with a metal oxide/hydroxide or composite metal oxide/hydroxide according to any one of claims 1 to 4, or with the product of any one of claims 5 to 23.
25. A method for catalysing a chemical reaction in a reaction medium comprising  
10 contacting the reaction medium with a metal oxide/hydroxide or composite metal oxide/hydroxide according to any one of claims 1 to 4, or with the product of any one of claims 5 to 23.
26. A method of manufacturing a supercapacitor comprising incorporating into a plate  
15 of said supercapacitors a metal oxide/hydroxide or composite metal oxide/hydroxide according to any one of claims 1 to 4, or with the product of any one of claims 5 to 23

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